To retrieve fossil fuels such as natural gas, oil and coal, you have to drill for them to get them out of the earth’s crust. In contrast to that, the energy carrier hydrogen does not occur in nature freely.

The most common way to generate hydrogen is in a chemical way, through the reaction of hydrocarbons such as natural gas with steam at high temperatures. In this process, hydrogen is released from the natural gas with the greenhouse gas carbon dioxide as a by-product. However, there is an alternative way to split water for hydrogen production, which is more competitive in price and efficiency. By means of electrolysis and other physical processes water is split into hydrogen and oxygen. Both gases have to be separated from each other with a membrane, to obtain hydrogen as pure as possible. Bronkhorst supported this process development by delivering mass flow controllers for hydrogen and oxygen flows.

Application requirements

As part of the process development, the performance of the membrane that separates hydrogen from oxygen has to be measured. To that end, both hydrogen and oxygen have to be supplied to the membrane in known amounts in an accurate way, and the flows that leave the membrane also have to be measured accurately.

Important topics

- Control accuracy
- Measurement accuracy

Process solution

In the experimental setup, with two mass flow controllers – a mini CORI-FLOW M14 for oxygen and an EL-FLOW Prestige for hydrogen - hydrogen and oxygen are fed to the membrane in a controlled way. The permeate - i.e. the part of the feed that passes the membrane - enters a three way valve where a choice can be made to measure the flow rate or the composition of the permeate gas flow. The flow rate is measured using another EL-FLOW Prestige device, and the gas composition by means of a binary gas sensor. This sensor can only handle a specific mass flow. The three mass flow controllers/meters used in this experimental setup were doing an excellent job. In addition, during a short period of time another mini CORI-FLOW M14 was ordered, to measure the mass flow of the retentate - i.e. part of the feed that is retained by the membrane.
Recommended Products

**EL-FLOW PRESTIGE FG-201CV**

- Min. flow 0.14…7 ml/min
- Max. flow 0.4…20 ln/min
- Pressure rating 64 bar
- 100 selectable gases
- Customized I/O configurations

**MINI CORI-FLOW™ M12V14I**

- Min. flow 0.1…5 g/h
- Max. flow 2…200 g/h
- Pressure rating 100 bar
- Independent of fluid properties
- High accuracy, fast control

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